

85 to about 15, in another embodiment about 60 to about 40, and in another embodiment 50 to about 50.

The mixture is emulsified using an emulsification device in the vessel, or alternatively the mixture flows from the vessel via a circular line to the emulsification device which is external to the vessel, for about 1 to about 20 tank turnovers, at a temperature in the range of about ambient temperature to about 212°F, and in another embodiment in the range of about 40°F to about 150°F, and at a pressure in the range of about atmospheric pressure to about 10 atmospheres, in another embodiment about atmosphere pressure to about 60 psi, in another embodiment in the range of about 10 psi to about 40 psi, resulting in stable aqueous hydrocarbon fuel emulsion with a mean droplet size of less than 1.0 micron, and in another embodiment in the range of about 1.0 micron to about 0.1 micron.

Examples 1-4

These examples are illustrations of making the hydrocarbon fuel emulsion product by a batch process. The blending equipment consists of a five-million-gallon-per-year batch blender.

Batch No. 1, using a 3:1 volume/volume ratio of raw material components to reactant emulsion:

1. A 25 gallon batch of hydrocarbon fuel emulsion was prepared using about 19.9 gallons of diesel fuel, about 4.4 gallons of water, and about 0.7 gallons of emulsifier A, which is the following:

	Concentrate % by weight
Emulsifier 1	40.00
Emulsifier 2	7.14
Emulsifier 3	19.80
2-ethylhexylnitrate	23.80
Ammonium Nitrate (54% by weight in water)	9.26

Emulsifier 1: Reaction product of dimethylethanolamine and PIBSA (Mn-2000)

Emulsifier 2: Reaction product of dimethylethanolamine and hexadecylsuccinnic anhydride

Emulsifier 3: Reaction product of an ethylene polyamine and PIBSA (Mn-1000)

This 25 gallons was left in the processing tank to serve as the reactant emulsion for the next batch.

2. About 59.6 gallons of diesel fuel was added to the processing tank followed by about 2.1 gallons of emulsifier A.

3. The reactant emulsion, diesel fuel, and emulsifier A were circulated through an IKA high shear mixer for about 30 seconds and back to the processing tank.
- 5 4. Following about 30 second mix and while continuing to circulate through the mixer, a total of about 13.3 gallons of water were added through a charging line immediately upstream of the mixer. The water feed time was about 85 seconds.
- 10 5. Once all water was added, the mixture continued to circulate through the IKA mixer for about an additional 12 minutes and 36 seconds.
- 15 6. Samples of emulsion were taken from the processing tank at various time intervals during this mix period representing 1, 2, 4, 7 and 9 tank turnovers. A tank turnover is defined as the duration to pump 100 gallons through the mixer.
7. The results are found in Table I.

20 Batch No. 2, using a 1:1 volume/volume ratio of raw material components to reactant emulsion.

- 25 1. A 50.1 gallon batch of hydrocarbon fuel emulsion was prepared using about 39.8 gallons of diesel fuel, about 8.9 gallons of water, and about 1.4 gallons of emulsifier A. This 50.1 gallons were left in the processing tank to serve as the reactant emulsion for the next batch.
- 30 2. About 39.7 gallons of diesel fuel was added to the processing tank followed by about 1.4 gallons of emulsifier A.
- 35 3. The reactant emulsion, diesel fuel and emulsifier A were circulated through the IKA high-shear mixer for about 30 seconds and back to the processing tank.
- 40 4. Following about 30 second mix and while continuing to circulate through the mixer, a total of about 8.8 gallons of water was added through a charging line immediately upstream of the mixer. The water feed time was about 56 seconds.
- 45 5. Once all water was added, the mixture continued to circulate through the IKA mixer for about an additional 12 minutes and 36 seconds.
6. Samples of emulsion were taken from the processing tank at various time intervals during this mix period representing 1, 2, 4, 7 and 9 tank turnovers. A tank turnover is defined as the duration to pump 100 gallons through the mixer.
7. The results are found in Table I.

50 Batch No. 3, using a 3:1 volume/volume ratio of raw material components to reactant emulsion. A concentrated emulsion formula was used for this example whereby

approximately 85% volume of the formula amount of diesel fuel was omitted during the processing.

- 5 1. A 25.1 gallon batch of concentrated aqueous hydrocarbon fuel emulsion was prepared using about 8.6 gallons of CARB diesel fuel, about 14.2 gallons of water and about 2.3 gallons of emulsifier A. About 25.1 gallons were left in the processing tank to serve as the reactant emulsion for the next batch.
- 10 2. About 25.6 gallons of CARB diesel fuel were added to the processing tank followed by about 6.6 gallons of emulsifier A.
- 15 3. The reactant emulsion, diesel fuel and emulsifier A were circulated through the IKA high shear mixer for about 30 seconds and back to the processing tank.
- 20 4. Following about 30 second mix and while continuing to circulate through the mixer, a total of about 42.7 gallons of water was added through a charging line immediately upstream of the mixer.
- 25 5. Once all water was added, the mixture continued to circulate through the IKA mixer for about an additional 16 minutes.
- 30 6. Samples of concentrated emulsion were taken from the processing tank at various time intervals during this mix period representing 1, 2, 4, 7 and 10.4 tank turnovers. A tank turnover is defined as the duration to pump 100 gallons through the mixer.
- 35 7. The concentrated emulsion was pumped to the diluter tank and diluted with about 229.3 gallons of CARB diesel fuel.
8. The diluter tank was circulated with a centrifugal pump for about 9 minutes.
9. A sample of the aqueous hydrocarbon fuel emulsion was taken from the processing tank.
10. The results are found in Table I.

Batch No. 4, using a 1:1 volume/volume ratio of raw material components to reactant emulsion. A concentrated emulsion formula was used for this example whereby approximately 85% volume of the formula amount of diesel fuel was omitted during processing.

- 45 1. About 50.1 gallon batch of concentrated aqueous hydrocarbon fuel emulsion was prepared using about 17.1 gallons of CARB diesel fuel, about 28.5 gallons of water, and about 4.5 gallons of emulsifier A. About 50.1 gallons were left in the processing tank to serve as the reactant emulsion for the next batch.
- 50 2. About 17.1 gallons of CARB diesel fuel were added to the processing tank followed by about 4.4 gallons of emulsifier A.